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II. *A Letter to the Royal Society concerning the Particles of Fat.* By Mr. Leeuwenhoek, F. R. S. Translated from the Dutch by John Chamberlayne, Esq;

Delft, May 1st, 1722.

I Take the Liberty to lay before you the following Observations, which I made about two Years past.

I have formerly said, that the Matter which we call Meal, or Flower, in Wheat, Rye, Barley, Oats, and in all sorts of Beans, is shut up as it were in little Cells or Chambers, and that those little Cells are separated from each other by thin Membranes, which are thinnest in Wheat. And forasmuch as in the Enquiry into what is called the *Periosteum* of an Ox or Sheep, I have often broke in Pieces the fat Particles thereof, and as often viewed thro' a Microscope the said broken Particles, so have I likewise placed a few of the fat Globules upon a clean Glass Plate, and afterward held the said Glass Plate over a Coal Fire, or the Flame of a Candle, so long, till they were all melted and reduced into a liquid Matter; so that not only the Fat, which was shut up in the Skin of the fat Globules, but likewise the Skin itself was reduced to a fluid Matter; and thereupon I immediately brought it before my Sight; and viewing it with Attention, perceived, when the melted Fat was cold, that there were different Matters inclos'd in the said fat Globules; for as much as there appear'd an inconceivable great Number of exceeding small coagulated Particles, and the rest of the

Parts, of which the Fat was compos'd, lay in one smooth and even Substance, as I have formerly said ; and I have been considering whether there might not be inclos'd in such a Globule of Fat, so many little Cells and Partitions as we see in a little Grain or Seed, but if it be so, it will remain concealed from our Eyes.

But having now again carefully contemplated these coagulated Globules of Fat, many of which go to the making of one little Bubble, I did often fancy, that I saw, that each of the said small Particles was provided with such a transparent Dent, as I have before said, that the Meal Globules of Wheat, &c. are furnished with : From which Observation I said to myself, since we find, that the great Creator of the Universe has made all his Creatures almost after the same manner ; and that there grows no Plant whatever, let the Seed be never so small, but there are inclos'd in it the same sort of Particles as are found in bigger Seeds ; and that tho' they differ in Magnitude, yet are they analogous one to the other : this being so, we may easily imagine, that a fat Globule has a Bark or Skin as well as any Seed, as we have often seen, and that they are furnished within with Particles analogous to those of the Seeds, which we call Wheat, Oats, and the like ; and altho' we render the Fat fluid by the help of Fire, yet will the small Particles which are inclos'd in the fat Globules, again resume their former Figure, as I have formerly said.

Yea I have fancied to myself, tho' it did not appear to my Sight, that each fat Particle is furnished with little Cells within, like the Seeds or Fruits of Plants.

Since I have set this down upon my Paper, I was informed that my Butcher had killed a Sheep of an uncommon Bigness, and that it weigh'd 140 Pounds, without the Fat that they took out of it, after it was
kill'd

kill'd, which weighed 51 Pounds, so that the whole Sheep weighed above 190 Pounds.

I caus'd a Piece of the Fat, that grew about the Kidneys of the said Sheep, to be brought to me, imagining that its fat Particles would be of a coarser Grain than those of ordinary Sheep; for I have observed several times, that the bigger an Ox was, the larger were the fat Particles thereof; and since not one Man in a thousand has any Knowledge of the Contexture of these fat Particles, for we find that there are not any two of one and the same Figure, they being compress'd by other Particles with which they are surronded, as I have frequently taken notice, I have caus'd some few of these fat Particles to be drawn here, as may be seen in *Fig. 1.* between A, B, C, D.

Now when we meet with one of these little Bundles of fat Particles, as has frequently occur'd to us, in which the fat Particles were four times this Thickness; I imagine, that such fat Particles cannot be produced out of one single adipose Vessel, but that out of such a Vessel several small Sprigs issue forth, and out of each of those small Sprigs proceed others still smaller, and that out of these Particles one larger fat Particle is formed like a Bunch of Grapes.

Now I cut off with a Razor the Fat in several Places of a greater Piece, as thin as I could, laying the thin Pieces upon several Glass Plates, and put them upon a Coal-Fire, so as to cause them to melt; and being melted, immediately view'd them with a Magnifying-Glass, when I observ'd the Skins, or membranous Coats, of the fat Globules lying among the melted Particles, and in the said melted Particles there was nothing to be perceived but a limpid Matter surronded with small Air-Bubbles; but when the Fat was congealed, we could observe but very little of the Mem-

branes, because they were covered with the Particles of Fat, with which these Membranes or Skins had before been filled.

I caused a few of these Skins of the fat Globules to be drawn, as may be seen here at *Fig. 2.* between E, F, G, H. During the said Observation, I fix'd my Eye with attention upon the fat Particles of the Sheep which had been melted, and were again coagulated; and I could not but judge, that these fat Particles, which were exceeding small, were analogous to that internal Matter, wherewith some of the smallest little Seeds are furnished, and in a great many of these exceeding small Particles, I could in clear Weather discover some Transparency.

Moreover, I cut as thin Slices as it was possible of the Fat, yea so thin, that five or six of them did not weigh a Grain, and put them into a little Water, in order to try whether I could make any farther Discoveries thereby, with respect to the small Particles of Fat; but it was in vain: only I saw floating upon the Water very small Particles of Fat, which were coagulated in a spherical Figure, and the very biggest of those fat Particles was no bigger than a Grain of Sand. I placed these Particles upon a Glass Plate; and viewing them with a Microscope, I observed the Figure, which I mention'd above, as plain as before; and other fat Particles seemed to be of a different Figure. I put one of these into the hands of my Painter, or Designer, bidding him to draw what he observed, it being the Figure of one of the said fat Particles, which was coagulated on the Water, as it is represented here by *Fig. 3.* between I, K, L, M, which was not very conformable with the other melted fat Particles; for in the doing it, all the Particles did not melt, for the fat Particles are not all extracted by the Water, and coagulate

agulate upon the Water in smaller and greater globular Particles ; and when we take out of it the Remainder of the thin Slices of Fat, which float upon the Water, and view them with a Microscope, we find that many of the fat Particles appear intire to the Eye ; and whereas they were before very smooth and even in their Sides, they were now changed into rough and uneven Particles ; so that one should be apt to think, that there were two different sorts of Particles in the Fat, and that one sort melted more easily than the other.

Now in order to get these melted Particles of Fat out of the Water, without altering them, I made use of a round Glass, and with it skimm'd the Superficies of the Water ; by which means some of the coagulated Particles stuck to the Glass. Moreover, I did again melt some of the fat Particles, which had been coagulated upon the Water, over a Coal Fire, as they lay in the Water ; and when they were again coagulated, viewing them with a Microscope, I found the small fat Particles to be yet smaller than those that were melted out of the Water.

In this last Observation I observed, with astonishment, the inconceivable Number of Veins and Membranes, which were diffus'd through the Fat, and the Multitude of separated fat Particles, that were involved in their several Membranes.

After this, there was laid before me the Hind-Quarter of a sucking Lamb, over which was spread what we call the Net, or Caul ; and having cut off some Pieces of the said Net, or Caul, upon which there was little or no Fat, with a Pair of Scissars, and placing them before a Microscope, I observ'd again, that the fat Particles, where there were very few of them included between the Membranes, were of a more
globular

globular Figure than in other Parts, where a good many lay together, and that in other Places they were pressed or bruised, which I fancy was occasion'd by the Butcher's squeezing the Caul in that place with his Fingers; and in another Place the fat Particles had been so torn in pieces, that I could see nothing remaining but the Skins of the fat Globules.

Moreover, I saw that the fat Particles had such a Pinch, or Dent, in them, as I have shewn, that there were in the Globules of Flower of Wheat; from which Spectacle, I am confirmed more than before in my Opinion, that the fat Globules might be separated intirely, or in part, from the Skin with which they are surrounded, by opening the Dents, without breaking the Skin.

Then I took off the thin Membranes, which encompass'd the fat Particles, and viewing them with a Microscope, observed, that the fat Particles had imprinted a roundish Figure on the Membranes, inclining to a hexangular Shape, that it was a Pleasure to look on 'em; but in other Parts they were of an oval Figure.

Moreover, I took a flat Fish, which we call *Plaise*, and took off the Fat which adher'd to the Vessels, or Bones, and viewed it with a Microscope, and observed, that the Fat Particles were of several Sizes; and some were so small, that I judged that fifty of the least were no bigger than one great fat Globule; and moreover, I saw that many of the fat Globules had such a Pinch in them, as we find in the Meal, or Flower, of those little white Beans, which we call *French* or *Kidney-Beans*.

Afterwards my Servant brought to me the Fat of a *Perch*, which was nine or ten Inches long, and taking a little of it, I viewed it with a Microscope, but could not discover any small Particles in it, nor any
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internal

internal Dent, as I had observed in the Fat of a small *Plaise*.

After that the Fat of the *Perch* had lain an Hour or two upon the Glass, I viewed it again, and observed that the Particles were lessened, or become smaller, and that the Skin of the fat Particles, which as yet was beset with some fat Particles, was, as it were, shrunk, or wrinkled, and the Fat that was burst out, lay about the fat Particles, and was so fluid and transparent, that we could not discover any Parts in it.

From this Observation I began to think, whether each of these fat Particles was not provided with an Orifice, or Hole, out of which the Fat might be protruded at all times, as often as the Parts of the Fish stood in need of Nourishment, without an entire laying open the Skin of the fat Globules ; for we constantly find, that when the Eggs of the *Perch*, which we call the *Roe*, increase in Bigness, its Fat decreases ; yea in such a manner, that when the said Eggs, or *Roe*, are arrived at their utmost Bigness, there is seldom or never any Fat to be seen upon the Intestines of the Fish.

Thus far my Notes go about Fat ; and if my Health will allow me, I shall shortly transmit to you some more of the Observations which I have set down in writing.